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ABSTRACT

Recent research has shown that when individuals hear an impoverished, atypical, or disorganized story and are asked to recall it, they can and do produce a canonical version of it. To determine if this "strategic" manipulation of story structure undergoes developmental changes, two experiments were conducted using second and sixth grade children and college students. In the first experiment, 40 subjects at each grade level listened to "normal" or "scrambled" versions of stories and either recalled them as heard or recalled them as good (organized) stories. Results showed that scrambled stories generally depressed recall and that there was a clear improvement with age/grade in the ability to recognize a scrambled story, with second grade subjects performing especially poorly. The second experiment examined two alternative explanations for the poor performance of the second grade students: (1) younger children's memory for material they have just heard is "fragile," and any attempt to operate on it or transform it is doomed because the effort detracts from the effort to hold on to the memory itself; and (2) sequencing techniques needed to reorder a scrambled story are not well mastered in young children. Eighteen second grade children were trained to sequence the propositions of a random story into a canonical form, with the propositions continuously available for inspection, while a control group of 18 subjects received no special training. Results confirmed that second grade students could reorganize their recall only if some training in sequencing were offered them. (FL)

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Working Paper No. 308

DEVELOPMENT OF CHILDREN'S USE OF A STORY SCHEMA TO RETRIEVE INFORMATION

by

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Abstract

Two experiments examined the individual's ability to retrieve information from simple stories. In Experiment 1, second-grade, sixth-grade, and college subjects heard normal or scrambled stories and either recalled them exactly as heard or recalled them as good stories. Scrambled stories generally depressed recall and there was a clear improvement with age/grade in the ability to reorganize a scrambled story, with second graders performing especially poorly. In Experiment 2, we examined two alternatives for second graders' poor performance. First, it may be that younger children's memory for material they have just heard is "fragile" and any attempt to operate on it or transform it is doomed because the effort involved detracts from the effort to hold on to the memory itself. A second alternative is that the sequencing techniques needed to reorder a scrambled story are not well mastered in young children. Results confirmed that second graders can reorganize their recall only if some training in sequencing is offered.

Recently, a great deal of attention has been focused on the formal structure of narrative prose and its impact on memory and comprehension. One approach has been to characterize the major components of simple stories with a formal grammar (e.g., Mandler & Johnson, 1977; Rumelhart, 1975; Stein & Glenn, 1979). The grammar is a set of rules specifying the structural units present in a story and the manner in which they are logically ordered and related to one another (see Table 1). Thus, the grammar specifies both the ideal

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Insert Table 1 about here

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form of what the reader/listener expects in a story (i.e., the schema) as well as what might be directly experienced (i.e., heard or read).

One powerful demonstration of the psychological effect of such structures is that when individuals hear an impoverished (Stein, 1976), atypical (Mandler & DeForest, 1979), or disorganized (Stein & Nezworski, 1978) story and are later asked to recall it, they can and do produce a canonical version of it. For example, Stein and Nezworski presented simple stories (see Table 1 for an example) to adults and asked them either to recall them exactly as heard or in such a way as to make good stories out of them. One group heard canonical stories like the one in Table 1. Other groups heard stories where the constituent propositions were rearranged to produce logical scramblings. Those subjects asked to recall the scrambled stories exactly as heard did poorly in contrast to those with the same instructions who had heard well-formed stories. However,

subjects who heard scrambled stories and were asked to retrieve them as good stories performed better when compared with their exact recall counterparts. They remembered more propositions and they reorganized the scrambled version so that it more closely resembled the canonical story order. These results indicate that adults can readily utilize the grammatical schema to retrieve and reorganize what has been heard.

The purpose of the present investigation was to determine if this 'strategic' manipulation of story input undergoes developmental change. It was hypothesized that young elementary school children would not benefit much from use of this strategy, but that older children and adults would. This hypothesis was based on the evidence that young children find it difficult to consciously manipulate the contents and structure of already established memories (e.g., Piaget & Inhelder, 1973; Salatas & Flavell, 1976), but that older children can do so rather easily. Two experiments were conducted. Experiment 1 partially replicated the design employed by Stein and Nezworski, but with second and sixth graders as well as adults. Experiment 2 sought to induce successful use of the strategy in young children and thereby test two different ideas about why they had limited success with it.

Experiment 1

Method

Subjects. A total of 120 subjects participated in Experiment 1. There were 40 children each from second and sixth grades and 40 college students. The children came from two grade schools in the Madison area. College students were volunteers recruited from classes in Educational Psychology at the University of Wisconsin-Madison. The respective mean ages were 7 years and

7 months, 11 years and 5 months, and 20 years and 4 months. All subjects were native English speakers, predominantly white, and middle class.

Materials. Three stories of the simple narrative form used by Stein and Glenn (1979) and shown in Table 1 were used. All were one-episode narratives containing the six grammatical categories, with two propositions per category. One version of each story was a canonical version. Two different scrambled versions of each story (i.e., random sentence orderings) were also constructed with the constraint that no two ordinarily consecutive propositions were adjacent, and the beginning (Setting) and ending (Reaction) propositions were also moved from their usual positions. Each story was recorded on a cassette tape for the children. The college students read each of their stories from a separate page in a booklet.

Design. Four treatment groups were created by crossing the instructions to recall the stories exactly as heard or recall the stories in a way which makes them good stories with the presentation variable of standard stories or scrambled ones. The four groups were: (a) Exact recall-standard, (b) Exact recall-scrambled, (c) Make-a-story-standard, and (d) Make-a-story-scrambled. The recall instructions were given before subjects heard or read the stories and were repeated just before recall was attempted. Each subject was randomly assigned to one of the treatment conditions.

Procedure. Children were tested individually, while adults were tested in small groups of three to five people. In all of the conditions, subjects were presented with all three stories and, following a 1-minute interpolated task, were asked to recall each of the three stories orally (children) or in writing (adults). In the interpolated task, subjects solved either addition

problems (children) or number series problems (adults).

Results

Following Stein and Nezworski (1978), subjects' recall protocols were scored for semantic agreement with the original story, which could be divided into 12 propositions. Interjudge agreement of the scoring on a proposition by proposition basis was extremely high, $\kappa = .96$ (Cohen, 1960), for 12 randomly selected protocols. The first and third authors served as independent judges.

The recall results are presented in Table 2. A set of nine planned

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Insert Table 2 about here

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comparisons was conducted using Dunn's procedure to control the overall α level (which was $\alpha = .10$ overall, $\alpha = .01$ for each comparison). The first subset of six comparisons contrasted a standard presentation group with its random counterpart within a presentation condition (e.g., mean 1 vs. 2) All comparisons yielded a significant difference, except the adults in the Make-a-story condition (e.g., means 11 vs. 12) and the sixth graders in the Exact recall condition (e.g., means 5 vs. 6), the latter contrast yielding a marginal effect ($p < .07$). Thus, random story presentation had a fairly uniform effect of depressing recall across grades and conditions.

The ability of various age groups to use the "story schema" to facilitate recall, however (the "strategy" spoken of in the introduction), is directly assessed by comparing the performance in corresponding random groups across the two recall instructions for each grade (e.g., means 2 vs. 4). This second subset of three planned comparisons showed that neither second (means 2 vs. 4) nor sixth graders (means 6 vs. 8) recalled random stories any better following

Make-a-story instructions than Exact recall instructions, but adults' scores differed reliably (i.e., means 10 vs. 12). Apparently, adults can benefit from instructions to impose a schema on a random story, but even older children cannot.

However, this conclusion must be modified somewhat when we examine recall organization. Here, the results indicated that sixth graders do utilize the schema to reorder the story even if their overall recall is not improved. Recall organization was assessed for the degree to which recalled propositions were ordered in concordance with the standard, canonical form of the story. For each story recalled, a separate Kendall's Tau concordance measure was computed. The resulting group means are presented in Table 3. A set of planned

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Insert Table 3 about here

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comparisons parallel to those done for recall was conducted on these organization scores. The comparisons revealed that random presentation generally depressed the degree of concordance (e.g., mean 1 vs. 2) and all three differences between means under Exact recall instructions differed reliably. This result is to be expected under Exact recall instructions, where subjects are explicitly told to output the scrambled story as is. The low scores at all ages (means 2, 6, 10) reflect the tendency to do this. However, note that under Make-a-story instructions the large gap between standard and random presentations, decreased from second grade (.80 vs. .33 = .47) to sixth grade (.99 vs. .70 = .29) to college (.98 vs. .89 = .09). A Scheffé post hoc comparison revealed that this grade x presentation type interaction was significant ($p < .05$). Furthermore, in the random presentation condition, sixth

graders and college students had significantly higher concordance measures under Make-a-story instructions than under Exact recall instructions (i.e., for sixth, .70 vs. .30; for college, .89 vs. .38), but second graders did not (i.e., a slight nonsignificant reversal, .33 vs. .46). Thus, both the sixth graders and the adults were successful at reordering random propositions in the direction of the canonical story form and achieving a fairly high concordance in doing so.

Experiment 2

Why did the second graders do so poorly? The inducement to use a story scheme (i.e., Make-a-story instruction) to benefit recall had no apparent impact. It did not enhance the amount recalled or the form of the stories they put out. Two explanations of these results occurred to us. First, it may be that the younger children's memory for what they had just heard is "fragile"; any attempt to operate on or transform it is doomed because the effort involved detracts from the ability to hold on to the memory itself. A second possibility is that the sequencing techniques needed to reorder a scrambled story are not well mastered in young children, even though the final story form seems well ingrained and known (see Stein & Glenn, 1979 for supporting arguments on this). Of course, both explanations might be correct--children might be hampered by inadequate memories as well as by inadequate logical sequencing skills. To test these ideas, a small scale training study was undertaken.

The logic of the study was as follows: Children were asked to output random stories as good stories (as in the earlier Make-a-story instruction) following one of three types of training. A memory group was trained to recall a random story in perfect random order, so that memory for each of the propositions

was guaranteed. A sequencing group was trained to sequence the propositions of a random story into a canonical form, with the propositions continuously available for inspection (thus, no memory was required). Finally, a control group had no training experience. If the earlier inability of second graders to output good stories after learning scramblings of them (Experiment 1) is due to fragile memory, then the memory training should enhance performance. If the locus of the children's difficulties is in knowing how to sequence propositions, the sequencing training should help. The control group serves as a comparison point. In this study, measures of organization are critical, since the groups by necessity and definition must have different amounts of training in memorizing the propositions in the test story.

Method

Subjects. Thirty-six children were recruited from several comparable elementary schools during the summer following second grade. As in Experiment 1, they were drawn from the Madison area, were predominantly white and middle class, and averaged 8 years, 2 months.

Materials. Six abbreviated stories were constructed using a modification of the story grammar proposed by Stein and Glenn (1979). Each story contained four sentences corresponding to the Setting, Initiating Event, Attempt, and Consequence categories of the grammar. Short stories were used to simplify the young children's task in the training activity, particularly in the memory training condition where the goal was to have the child memorize the story propositions to a perfect criterion. It would have been difficult to obtain such mastery with longer stories. Previous work has established that these categories constitute a "kernel" story sequence (Stein & Glenn, 1979; Yussen,

Mathews, Buss, & Kane, 1980). Three of the stories were randomly designated as training stories and the remaining three were used during testing. Each sentence of the training stories was typed on a 2 cm x 10 cm strip of white tag board.

Design. Children were randomly assigned to one of three experimental conditions: Control, Sequencing Training, or Memory Training, so that there was an equal number (12) in each. In training conditions, children were trained with three stories and tested on three. For memory training, the stories in the two phases were the same. For sequencing training, the stories in each phase were different. The control group received only the test phase. All stories were scrambled in a different way, so that each story had a different random order. Assignment of stories to control and test phases was randomized across children, with the constraint that each story was equally represented in phases. The first and fourth authors served as experimenters.

Procedure. Each student was tested individually during one 20-minute session. The experimental session was divided into a training and testing phase. Students in all conditions received the same instructions during the testing phase of the experiment. However, only the students in the Sequence Training and Memory Training conditions received an additional training phase. These training procedures are outlined below.

For the Sequence Training condition, students were given a three-step series of instructions on how to sequence scrambled stories. A different story was used for each step of the training phase.[1] At the beginning of each step, the experimenter orally read and displayed one of the scrambled training stories. For the first step, the students were asked to watch as the experimenter put the story in its correct order and to listen as the experimenter

provided a rationale for the correct story sequence. The explanation contained a brief summary of the necessary information included in the Setting, Initiating Event, Attempt, and Consequence sentences. In addition, a question incorporating the same information was formulated in order to help a child identify the correct sequence of sentences. The explanations given during the first step of Sequence Training are shown in Table 4.

Insert Table 4 about here

In the second step of the Sequence Training procedure, the children were read and shown another scrambled training story and then were asked to orally read the scrambled story themselves. After this, each child was told that they would be asked some questions to help them rearrange the story into its correct order. The four questions corresponded to the underscored portions of the explanations in Table 4 which had been given during the first step. If the child responded with the correct story part (i.e., sentence) s/he was told, "Yes, that part comes first or second, etc." and was then asked the next question. If the child chose an incorrect story part, the experimenter said "No, that is not the right part, look and see if you can find the story part that tells you _____." (The question was restated.) After the story had been correctly rearranged, the child was told to orally read the story. The experimenter then commented that the story sounded better and now made more sense. Finally, in the third step of the Sequence Training procedure, the child was asked to rearrange a third scrambled story without any assistance. As the child sequenced each story part, the experimenter asked why a particular sentence had been chosen first, second, third, or fourth. None of the children erred in arranging story propositions

in this third step, so no correction procedure was necessary. After training, children heard and recalled three new target stories during the test phase.

Students in the Memory Training condition received instructions as follows: For each of the three scrambled stories, the child was first asked to listen carefully to the story and to try to remember it exactly as it was read by the experimenter. The experimenter then read the story as the child followed along by reading it on the cards. The story was then covered and the child was asked to recall the story exactly as it was heard. The order of recall did not have to correspond to the scrambled order that had been presented. Furthermore, close paraphrases which reproduced the propositional information contained in the four sentences were accepted. However, if a child missed any of the story propositions, the scrambled story was reread and reshown and the child was asked to recall it again. This procedure continued until the child was able to recall all four story propositions two times without errors for each of the three stories. Afterwards, the test phase was initiated. The child was asked to recall each narrative from memory so that it "Made-a-good-story." The narratives were cued in the same order as they had been trained, with the main character's name mentioned to identify the story the child was to recall.

Control subjects were merely presented with the scrambled stories in the test phase and similarly asked to recall each one as a good story after hearing all three of them.

Results

The training activities progressed smoothly and rapidly. It did not take children long either to sequence a story correctly or memorize all the propositions within it to a perfect criterion. In sequencing, for example, all the

children could correctly order the propositions in the third and final training story without error. In memory training, children never exceeded four trials to output all story propositions in a given story twice and often did it in three trials (hence, only one trial where any errors were committed).

The principal dependent measure for the test phase was the concordance between the order in which story propositions were recalled and the order predicted by the canonical form. As in Experiment 1, this was determined by the Kendall Tau statistic. The mean concordance scores across the three stories for the Sequence Training, Memory Training, and Control groups were respectively, .89, .69, and .58 (see Table 5). Planned comparisons showed that

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Insert Table 5 about here

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the Sequence Training group differed reliably from the Control group, $p < .02$, and marginally from the Memory Training group, $p < .06$. However, the Memory Training and Control groups did not differ from each other.

The results suggest that attempts to overcome memory deficits alone do not have an impact on the child's ability to manipulate memory. However, brief training in sequencing story propositions so that they conform to the canonical order had a dramatic impact on the children's ability to reorganize memory. So, a reasonable answer to the question which motivated the investigation is: Young children are unable to consciously use the story scheme to manipulate the order of remembered information because of a deficit in sequencing ability. The source of the deficit is uncertain, but it can be easily corrected in a brief training session of about 20 minutes.

Supplementary Data and Results

If second graders have a problem in sequencing the propositions of scrambled stories such as those used in Experiments 1 and 2, it should be possible to document this deficit in the absence of the task requirement to remember the propositions. And since the two experiments employed stories of such different lengths (12 versus 4 propositions), the skeptic might well wonder whether the claimed sequencing difficulties apply equally well to both situations. To satisfy these concerns, an informal study was conducted with 12 second graders[2] (Fall semester) drawn from the same school district area as before, with similar SES characteristics. Each child was shown two of the stories from Experiment 1 and two from Experiment 2, one at a time. The propositions of each story were displayed, as in Experiment 2, in a scrambled sequence in a vertical column, with each proposition typed on a strip of white tag board. The experimenter and child read each story together and then the child was asked to move the strips of tag board around until a "good-story" (from top to bottom) had been produced. The child was given one untimed opportunity to rearrange each story. Half of the children were presented with the two 4-proposition stories first; the other half received the two 12-proposition stories first.

Applying the same measure of concordance employed in analyzing recall data from Experiments 1 and 2, and limiting our concern to the initial two sequencing opportunities[3], the mean concordances were .50 (SD =.40) and .60 (SD =.37) for the 4 and 12 proposition stories, respectively. A simple *t*-test revealed no statistically significant difference between the means. The practical importance of this finding is that (a) young children do have room for improving their sequencing of propositions within a single episode, even when their sequencing

ability is gauged in the absence of a memory task, and the room for improvement is large in both the short (4 propositions) and long (12 propositions) stories employed in the two experiments. Therefore, it is reasonable to infer that the phenomenon of interest is similarly "potent" in the two experiments.

Conclusion

Natural events often exhibit a clear, logical, and temporal structure. This is the case for simple stories and folktales read by young children. One skill in reading is to be able to follow this logical sequence or to construct it, if the author violates it. The importance attributed to this skill is attested to by the large number of exercises appearing in reading workbooks to train it in young elementary school children.

The present experiments offer important descriptive data on the development of children's ability to strategically use one logical form to guide memory--a single episode story scheme. Young elementary school children (second graders) do not readily use this form to organize their memories, whereas older elementary school children (sixth graders) and adults do. The older children benefit primarily in memory organization when they employ the scheme, whereas the adults benefit in both memory organization and the amount recalled.

A plausible explanation for the young children's difficulty in using the scheme is their lack of skill at how to sequence "within-episode" propositions. This explanation is supported by the positive effect of a short training activity in how to sequence, and second graders' mediocre ordering of propositions in the absence of a memory requirement (see Supplementary Data and Results). The training activity does not pinpoint the specifics of what the children lack, however. For example, in training, the experiment both modelled the correct

ordering of propositions within the episode and explained the cognitive basis for the ordering. Either component alone might have accounted for children's improvement - the modelling, or the explanation. Future research may shed light on the fine-grained details of what matters in training.

An equally important future extension of this work is to analyze the limits to which children may benefit from training. For example, if children are trained to sequence short stories such as the ones employed here, will the training benefit them as they process more complex narratives. Several dimensions of complexity suggest themselves - length, the number of episodes, and episodic complexity, e.g., interleaving or embedding. It remains an open and fascinating question to determine what experience (training) is sufficient to improve young children's sequencing ability.

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Footnotes

[1]Once three stories had been randomly selected for the training phase of the Sequencing condition for a given subject, a second randomization was done to assign stories to the various training phases.

[2]We also tested a few children at older elementary school grades (3 and 6 to be precise) informally. Their sequencing performances uniformally hovered near a perfect level (i.e., .80 and up) for both types of stories.

[3]We also analyzed the data from all four sequencing trials, but observed a practice effect in the latter trials. Since the practice effect is beyond the scope of the present discussion, it is not discussed further.

Table 1

Representative Stories Employed in Each Experiment

	Experiment 1	
Setting	1.	Once there was a big gray fish named Albert.
	2.	He lived in a pond near the edge of a forest.
Initiating event	3.	One day Albert was swimming around the pond.
	4.	Then he spotted a big juicy worm on top of the water.
Internal response	5.	Albert knew how delicious worms tasted.
	6.	He wanted to eat that one for his dinner.
Attempt	7.	So he swam very close to the worm.
	8.	Then he bit into him.
Consequence	9.	Suddenly, Albert was pulled through the water into a boat.
	10.	He had been caught by a fisherman.
Reaction	11.	Albert felt sad.
	12.	He wished he had been more careful.
	Experiment 2	
Setting	1.	Once there was a fish named Albert.
Initiating event	2.	One day he saw a worm.
Attempt	3.	Albert bit into the worm.
Consequence	4.	He was caught by a fisherman.

Table 2

Means and Standard Deviations for the Number of Story Propositions Recalled for Each Grade, Instruction, and Presentation Condition in Experiment 1

Grade	Instruction and Presentation							
	Exact Recall				Make-A-Story			
	Standard		Random		Standard		Random	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
2	$5.13^{a}_{(1)}$	1.36	$2.97_{(2)}$	1.67	$5.00_{(3)}$	2.74	$2.73_{(4)}$	1.50
6	$6.50_{(5)}$	1.50	$4.67_{(6)}$	.72	$6.83_{(7)}$	1.30	$4.40_{(8)}$	1.80
College	$7.30_{(9)}$	2.10	$3.27_{(10)}$	.77	$6.93_{(11)}$	1.28	$5.30_{(12)}$	1.84

[a]Each mean is based on 30 observations (10 subjects x 3 stories each). Numbers in parentheses arbitrarily identify means for the purpose of following the planned contrasts described in the text.

Table 3

Means and Standard Deviations for the Concordance Between Subjects' Output Order for Propositions and the Canonical Story Order of Propositions for Each Grade, Instruction, and Presentation Condition Using Kendall's Tau Statistic in Experiment 1

Grade	Instruction and Presentation							
	Exact Recall				Make-A-Story			
	Standard		Random		Standard		Random	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
2	$.93^{a}_{(1)}$	.14	$.46_{(2)}$	.35	$.80_{(3)}$	.25	$.33_{(4)}$	.42
6	$.99_{(5)}$	.01	$.30_{(6)}$	.22	$.99_{(7)}$	.02	$.70_{(8)}$	.23
College	$.96_{(9)}$	.10	$.38_{(10)}$	.37	$.98_{(11)}$	.03	$.89_{(12)}$	.11

[a]Each mean is based on 30 observations (10 subjects x 3 stories each). A mean of 1.00 is perfect concordance, 0 is the absence of concordance.

Table 4

Instructions Used in Experiment 2 for the First Step in Sequence Training

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First, I need to know what the character is and the name of the character. So I ask myself: Which part tells the character's name and what the character is? That part goes first. In this story, this part (E points and reads) tells what the character is and what the character's name is. That means this part comes first.

To find out which part comes next, I have to know what happened or what the character did so that the story can begin. I need to know what happened first. To find this part I ask myself: Which part tells what happened or what the character did to make the story begin? That part goes second. In this story, this part (E points and reads) tells what the character did or what happened to start the story. This part comes second.

Next, I have to find out what the character did after the story was started. The second part tells how the story begins and the third part tells what happened after that. To find out what part is third I ask myself: Which part tells what the character did after the story began? In this story, this part (E points and reads) tells what the character did after the story began.

The last part tells what happened to the character in the story or what the character finally did in the story. If I need to find which part comes last, I ask myself: Which part tells what happened to the character or what the character finally did in the story? This part comes last. In this story, this part (E points and reads) comes last and tells what happened to the character or what the character finally did in the story.

Table 5

Means and Standard Deviations for the Concordance Between Children's Output Order and the Canonical Story Order During the Test Phase for Each Training Group in Experiment 2

Training Group					
Sequencing		Memory		Control	
$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
.89	.15	.69	.30	.58	.35